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MASTITIS PREVENTION: ENVIRONMENTAL CONTROL

(Revision of Factsheet "Mastitis Prevention: Environmental Control", December 1983)

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Mastitis is one of the most common and costly diseases of dairy cattle. It can be controlled by applying a management program which includes: (1) a clean, stress-free environment: (2) proper maintenance and operation of milking equipment: (3) good milking procedures including teat dipping: (4) a dry cow treatment program; and (5) a program for monitoring udder health status. This Factsheet outlines the environmental factors of mastitis prevention.

Mastitis is an infection of the udder caused by bacteria entering the quarter through the teat end. When the udder is exposed to greater numbers of bacteria, because of a dirty environment, or when teats are damaged, allowing easier bacterial invasion, infection is more likely to occur. About 97% of all mastitis cases are "subclinical". While these cases do not involve visible changes to the quarter or the milk it produces, they do result in lower milk production and an increased somatic cell count. In subclinical cases, the cow's natural resistance to disease limits the spread of the bacteria in the udder. When stress lowers this resistance to disease, subclinical infections are more likely to flare up and become clinical cases. Some types of stress may also allow easier penetration of the teat, thereby increasing the number of new infections. Since clinical cases are easily identified, dairy men tend to be aware of stress factors which cause flare-ups but less sensitive to factors which causes new infections. This Factsheet emphasizes those environmental factors which influence rates, since reducing the number of new subclinical cases is the most effective way to control mastitis.

Infections caused by coliform bacteria are less common than other types, but can cause very severe cases of clinical mastitis. Coliform bacteria are abundant in wet bedding materials, manure and polluted water. Coliform mastitis occurs more frequently in herds which are relatively free of other types of mastitis infections, are housed in unsanitary conditions or milked while the udders are wet. Coliform infections are more common in cows under stress. Where coliform or mastitis is a problem, attention should be given to general cleanliness of the environment, and particularly, the cleanliness of bedding materials in stalls.

Klebsiella and *Streptococcus non-agalactia* are other organisms associated with the environment. When culture results show these organisms predominate, environmental control measure should be reviewed.

Three main goals in the environmental control of mastitis are as follows:

1. Decrease the number of bacteria in the cow's environment, particularly in areas which come in contact with the udder.
2. Prevent teat injuries.
3. Reduce or eliminate environmental stress.

FEEDING

Although dairymen have often blamed feeds for clinical mastitis flare-ups, high energy or high protein diets do not increase or decrease the number of new infections. Feeding high producing cows for maximum production does increase stress on the udder and may cause infected cows to flare-up, however, restricting production to reduce clinical mastitis is not realistic or economical. Health problems at calving, particular those which result in downer cows increase the risk of mastitis infections. The incidence of these health problems can be reduced by separating the dry cows from the milking herd and feeding a properly balanced dry cow ration.

Research has shown that certain vitamins and minerals are important in fighting infections. Deficiencies of selenium, vitamin E and vitamin A increase both the number of new infections and clinical cases of mastitis. Excessive levels of other elements such as iodine, reduce disease resistance. A balance ration containing recommended levels of all nutrients improves the cow's resistance to all infections including mastitis. Selenium at 0.3 parts per million, vitamin E at 15 international units per kilogram and vitamin A at 3,200 to 4,000 international units per kilogram of dry matter in the total diet are recommended. The formulation of mineral supplements in many typical diets, especially for dry cows, is often inadequate to meet these levels.

HOUSING

Studies comparing housing systems tend to show slightly lower mastitis incidence in free stalls than in tie

stalls or loose housing. Regardless of the system used, general cleanliness of the environment is a major factor in determining overall exposure to mastitis organisms. Dirt lots, stagnant ponds, accumulation of manure, overstocking, and irrigation of pasture with manure increase bacterial exposure and risk of mastitis. Loafing areas should be large enough and properly drained to support normal growth of grass, or they should be paved with concrete and cleaned by regular scraping. Cattle should not have access to ponds where they may stand with their teats in the water, or to pasture areas to which manure has recently been applied. Alleys in solid floor free-stall barns require regular scraping, and obstructions which may come in contact with teat ends should be eliminated. Sunburned of frozen teats are more prone to new infections, therefore, the housing systems should provide adequate shade, and protection from winter winds, particularly immediately after milking. If cows must exit directly outside from a milking parlour, radiant heaters in the parlour combined with a brief delay before cows are released, will ensure teats are dry and prevent freezing. **It should be noted that many new mastitis infections occur early in the dry period and shortly before calving. Clean well bedded housing facilities for dry cows are at least as important as proper housing of the milking herd.**

STALLS

When stalls are too small, a higher incidence of teat injuries occurs. In free-stall barns, cows are less likely to lie in dirty alley ways if free stalls are of adequate size, and at least nine stalls per 10 cows are provided. Harder stall surfaces such as concrete or wood reduced cow comfort and may increase teat injuries, however, these stalls require less labor and maintenance than clay or lime based stalls, and are satisfactory if enough bedding is used. Some dairymen report reduced problems with cows digging out clay based free stalls when 13 or 14 inch used car tires with holes drilled in the bottom for drainage are embedded in the stall based. Concrete free stalls and cow stands in tie stalls should have a 2% slope to the back. To retain bedding and improve footing, a 25 mm (1") lip may be provided at the back of the stall or cow stand, but opening must be left for supporting drainage of liquids. A metal pipe supported 25 mm (1") above the back edge of the platform provides an excellent "bedding keeper" with adequate space for drainage.

Excessively large stalls promote a build-up of manure which increases exposure to mastitis causing organisms. Stall length, and freedom of movement in the tie-up system are more critical than width of stalls or presence of partitions. Recommended stalls sizes are given in Table1. For tie-stalls, cow trainers, suspended 60 mm (2.5") above the cow's back 150 mm (6") behind the point of the shoulder are recommended. For free stalls, a neck or head rail is essential to keep cows back when standing. Cow comfort may be further improved in traditional stall designs by adding a slightly sloping brisket board 200 to 250 mm (8 to 10") high located 700 to 800 mm (28 to 31") from the front of the stall and removing the head rail.

Table 1 Recommended Stall Sizes for Dairy Cattle

Dimension for Tie Stalls

Cow Size		Platform Width		Platform Length	
kg	lbs	mm	(in.)	mm	(in.)
400	880	1050	41	1450	57
500	1100	1150	45	1550	61
600	1320	1250	49	1650	65
700	1540	1350	53	1750	69
800	1760	1450	57	1850	73

** Length is with use of cow trainers. If no trainers used decrease stall length by 100mm (4 in.).*

Dimension for Free Stalls

Cow Sizes		Stall Width		Stall Length	
kg	lbs	mm	(in.)	mm	(in.)
400	880	1000	39	2100	83
500	1100	1150	45	2200	87
600	1320	1250	49	2300	91
700	1540	1350	53	2400	95
800	1760	1450	57	2500	98

Locate neck rail 900-1100 mm (35-44 in.) above stall surface and 1500-1700 mm (59-67 in.) from rear curb of stalls. Locate brisket board 200-250 mm (8-10") high and 700-800 mm (28-31 in.) from the front of the stall.

New designs, including "mushroom" and "suspended" free-stall, partitions, Figures 1 and 2, offer greater freedom of movement and cow comfort than traditional partitions. Fewer injuries are associated with these designs.

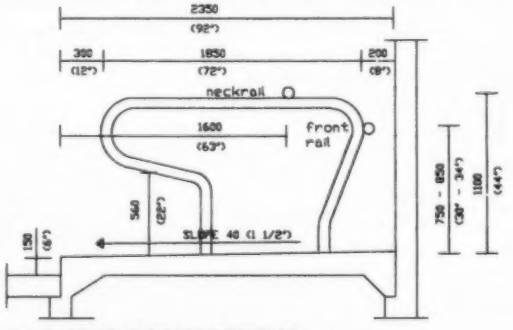

Figure 1. MUSHROOM PARTITION

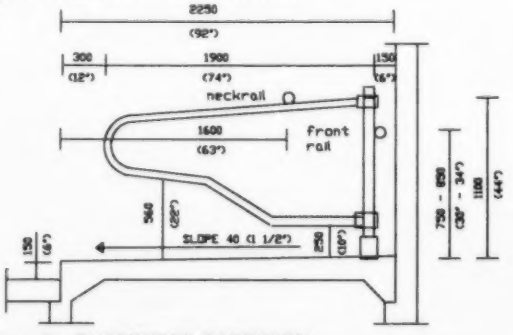

Figure 2. SUSPENDED PARTITION

In tie stall barns, single head rail stalls allow cows to move forward with head down for feeding, but keep them back when the head is up. These stalls are lowest in cost and can be designed to release an entire row at the same time. Chain ties restrict sideways movement of the head giving greater control over individual feeding Cows have more freedom to move backwards or forwards.

Stanchions are more restrictive and may lead to a greater incidence of teat and leg injuries. Of these systems illustrated below, single headrail tie ups appear the most practical. Cowtrainers may be necessary for a few individual cows in tie stalls.

Figure 3, 4, and 5 show three different tie stall design options.

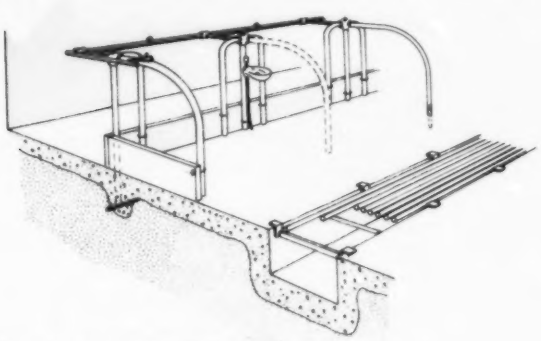

Figure 3. Single headrail tie stall.

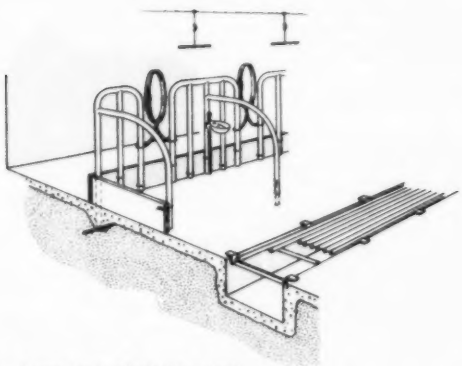

Figure 4. Low arch chain tie stall.

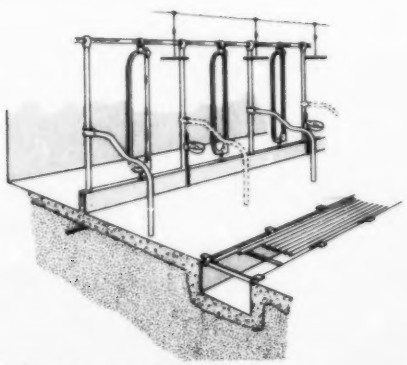

Figure 5. Stanchion tie stall.

BEDDING

Both tie stalls and free stalls require regular attention and at least 7 cm (2 1/2 in.) of bedding material.

Bedding is required to keep stalls dry, prevent a build up of bacteria, and for cow comfort. No perfect bedding material has yet been discovered. Free stalls, bedded with sand, have proven very effective in minimizing exposure of the udder to bacteria. Most bacteria do not multiply as quickly in sand as in "organic" bedding materials. However, sand may be impractical because it is extremely difficult to handle in most manure systems. Green, hardwood sawdust has been implicated in increased incidence of mastitis caused by a coliform organism called Klebsiella, and should be avoided as bedding material. Sawdust and shavings from kiln dried lumber present less risk, if kept dry in storage and in the stalls, but the risk of *Klebsiella* infection is still higher than with straw bedding. Adding lime to sawdust has not proven to be beneficial in reducing mastitis. Straw tends to harbour Streptococcus non-agalactia bacteria when it becomes damp, thus leading to an increased incidence of mastitis caused by these organisms. However, clean dry straw is an excellent bedding system. With all bedding, replacing wet soiled material daily is the key to controlling growth of bacteria and to reducing new mastitis infections.

Rubber mats improve cow comfort but still require bedding to keep stalls dry and improve footing. A new European designed mat made of canvas material backed with resilient fibers, has been shown to provide greater cow comfort than rubber mats. Though costly, these mats may prove more satisfactory than rubber when little or no bedding materials is available.

TINGLE VOLTAGE

Stray or tingle on stabling and milking systems has been blamed for high somatic cell counts and increased incidence of clinical mastitic in dairy herds. Research studies indicate that low level of tingle voltage are not a direct cause of high cell counts or mastitis. Stray voltage in milking parlours or tie stall barns can lead to nervousness during milking, reluctance to enter the milking parlour, and uneven milkout. When these behavioral symptoms are present, irritation, liner slips and increased stress during milking may lead to both clinical flare-ups and new mastitis infections. Stray voltage should be suspected as a contributor to mastitis only when these behavioral symptoms are present. The level of voltage which affects cows is highly variable depending on the electrical conductivity of cow contact points and the environment. It is believed to be in the 1 to 5 volt range under normal housing conditions. Stray voltage results from currents originating on the neutral network of the electrical system which pass through the cow from the stabling, feeding and drinking device to the earth. A high impedance voltmeter with a full scale reading 2 to 5 volts AC, and which does not record DC Voltage on the AC scale can be used to test for stray voltage. Many rural electricians, the Ontario Milk

Marketing Board udder health specialists, and OMAF engineering technicians are equipped to check barns for stray voltage.

Tingle voltage can be eliminated by the proper installation of a "tingle voltage filter", available from most electrical suppliers. Because proper installation of this equipment is critical, this device should be installed by a qualified electrician who is familiar with the equipment. An indicator light can be included in the installation to indicate failure of the filter.

In the construction of milking parlours, an equi-potential plane, consisting of 9 or 10 gauge welded wire mesh of any size up to 150 mm (6") should be installed. The wire mesh is embedded in the parlour and pit floor within 50 mm (2") of the surface, bonded to all metal parlour equipment and the neutral network. With this system, the cow is subjected to equal electrical potential at all contact points, and not subject to electrical currents even if stray voltage is present in the system. Detailed recommendations for dealing with stray voltage problems can be found in the OMAF Publication 155, *Stray Voltage Problems with Dairy Cows.*

VENTILATION

High temperature (above 25°C), high humidity (above (80%), and manure odours are recognized stresses on dairy cows. High humidity also increases exposure to air-borne organisms and increases the moisture content of bedding materials, thereby increasing the rate of bacterial growth in bedding. Adequate ventilation is important in all dairy cattle housing systems, both for cow comfort and to minimize exposure to mastitis causing bacteria.

CALF HOUSING

When calves fed mastitic milk are allowed to suck each other; infection can occur in the developing mammary gland. Therefore, milk fed calves should be housed in individual pens. Consumption of mastitic milk in itself will not lead to mastitic infection, although milk from clinically-infected cows may cause other health problems.

OTHER MANAGEMENT PRACTICES

Keeping cattle on their feet for the first hour after milking will reduce the exposure of the teat end to bacteria during a period when the risk of infection is high. The risk of infection is greater after milking because the sphincter muscle at the end of the teat is relaxed permitting easier bacterial invasion. Providing fresh feed during and after milking is a simple way to keep cows standing. Proper fly control, both on the cows and in the stable, is also important.

Flies cause stress and also carry mastitis causing bacteria from teat end to teat end.

Teat injuries, nearly always result from damage inflicted by the dew claws and hooves of the injured cow, and not by other animals. The frequency of teat injuries can be reduced by providing adequate sized stalls, eliminating pendulous udders through selection and culling. Udder supports and teat protectors over the dew claws, can be used to protect the teats of cows with larger udders during the high risk period at calving time. Removing the inside dew claw of newborn heifer calves may reduce the chance of self-inflected teat injury in adult cows. When teats are injured, teat dilators, or cannulae should be used only when absolutely necessary. Ensure dilators or cannulae are handled aseptically since their use greatly increases the risk of bacterial penetration of the teat.

A high incidence of mastitis in heifer at calving may result if one or more heifers have sucked the udders of others in the group. Heifers should be checked regularly for sucking activity or abnormal udder development and offending animals fitted with weaners or removed from the group.

Mastitis prevention requires a daily commitment from producers to maintain a high standard of cleanliness in the cow's environment and to prevent teat injuries. When high somatic cell counts, or high incidents of clinical cases indicate a herd problem, making appropriate changes in herd management and housing can significantly improve production and profitability of the dairy herd.

FOR FURTHER INFORMATION

Refer to the following OMAF Factsheets:

Dry cow Therapy,
Agdex 410/662

Somatic Cell Counts - Description and Interpretation,
Agdex 410/662

The Economics of High Somatic Cell Counts,
Agdex 410/662

Proper Milking Procedures,
Agdex 410/725

Understanding the Basics of Milking Machine,
Agdex 410/721

Maintenance of Milking and Milk Handling Equipment,
Agdex 410/715

Installation Recommendations for a Milk Pipline,
Agdex 410/725

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